On the geometrical Representation of the Powers of Quantities, whose Indices involve the Square Roots of negative Quantities. By the Rev. John Warren, *M.A. late Fellow and Tutor of Jesus College, Cambridge. Communicated by the President.* Read June 4, 1829. [*Phil. Trans.* 1829, *p.* 339.]

The author, in a former paper, read to the Society in February last, had discussed various objections which had been raised against his mode of geometric representation of the square roots of negative quantities. At that time he had only discovered geometrical representations for quantities of the form $a + b\sqrt{-1}$, of geometrically adding and multiplying such quantities, and also of raising them to powers either whole or fractional, positive or negative; but he was at that time unable to represent geometrically quantities raised to powers, whose indices involve the square roots of negative quantities (such as $a + b\sqrt{-1}^{m+n\sqrt{-1}}$). His attention has since been drawn to this latter class of quantities by a passage in M. Mourey's work on this subject, which implied that that gentleman was in possession of methods of representing them geometrically, but that he was at present precluded by circumstances from publishing his discoveries. The author was therefore induced to pursue his own investigations, and arrived at the general result stated by M. Mourey, that all algebraic quantities whatsoever are capable of geometrical representation by lines all situated in the same plane. The object of the present paper is to extend the geometrical representations stated in his former treatise, to the powers of quantities, whose indices involve the square roots of negative quantities. With this view he investigates various equivalent formulæ suited to the particular cases, and employs a peculiar notation adapted to this express purpose; but the nature of these investigations is such as renders them incapable of abridgement.

An experimental Examination of the Electric and Chemical Theories of Galvanism. By William Ritchie, *A.M. F.R.S. Rector of the Royal Academy at Tain.* Read May 7, 1829. [*Phil. Trans.* 1829, *p.* 361.]

After observing that the theory of galvanism originally proposed by Volta, and generally termed the Electric theory, is still the universally received doctrine among continental philosophers, the author adduces several experiments proving the fallacy of the principles on which that theory is founded. He points out the inconclusiveness of the reasoning by which it has been inferred that dissimilar metals, by being simply placed in contact with one another, are instantly thrown into opposite electric states; for in all the experiments which have been made with a view of establishing this fundamental principle of the electric theory, the metals have been exposed to the oxidizing action of the air, which is a constant source of electric disturbance, and the operation of which has been strangely overlooked. The

author found, by forming galvanic circles with two different metals and an interposed acid, that when he used different kinds of acid, or varied the degree of their dilution, the electro-magnetic effects, as measured by a delicate galvanometer, bear no sort of relation to the conducting power of the fluid, as is assumed in the Voltaic hypothesis. He deduces the same conclusion from experiments made with an apparatus by which the fluid is confined in a rectangular box, divided by a membranous diaphragm into two compartments, so as to allow of the addition of an acid to the fluid contained in one of the compartments, and thereby limiting its action to one of the metallic surfaces. By means of another contrivance, the author ascertained that of two different metals, the one which, when acted upon by an acid, combines with the greatest quantity of oxygen, as measured by the volume of hydrogen disengaged, is always positive with respect to the other metal. Even two pieces of the same metal, differing in hardness, will be acted upon by the same acid in different degrees, and may thus be brought into different states of electricity. In general it is the harder of the two pieces of metal which becomes positive; but with steel the reverse obtains. It would appear, however, that with the same pairs of metallic discs, the direction of the electric current is determined by the nature of the acid employed: thus nitrous acid, acting upon zinc, copper, or iron, gives rise to a current in a direction opposite to the current which is produced by the sulphuric, nitric, or muriatic acids. Variations in the temperature of the metals will also occasion diversities in the results, not hitherto satisfactorily explained on any theory. From one experiment the author is led to infer that an acid is capable of combining with a pure metal, without the latter being previously reduced to the state of an oxide.

The Bakerian Lecture. On the Manufacture of Glass for Optical Purposes. By Michael Faraday, *Esq. F.R.S. &c.* Read November 19, December 3 and 10, 1829. [*Phil. Trans.* 1830, *p.* 1.]

As an introduction to his paper, the author gives a short account of the circumstances which have led to the present inquiry. He states the difficulties that exist in procuring glass sufficiently homogeneous to answer the purposes of the optician, and adverts to the efforts made by Guinand and by Fraunhofer to overcome them. As the art was still imperfectly known in this country, the President of the Royal Society in the year 1824 suggested the appointment of a committee, whose labours were facilitated by the Government removing the restrictions imposed by the excise laws to experiments on glass, and also undertaking to bear all the expenses of the inquiry, as long as it held out a reasonable expectation of ultimate success. An experimental glass-house was at first erected on the premises of Messrs. Pellatt and Green, at the Falcon Glass-works; but Mr. Faraday being unable to conduct them at that distance from his own residence, the President and Council of the Royal Society obtained leave